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Remarks on the fossil Chelonians from Mălușteni in Southern Moldavia, Romania

[Pp. 151—162, with 3 text-figs.]

Uwagi o żółwiach kopalnych z Mălușteni w południowej Mołdawii, Rumunia

Заметки о ископаемых черепахах из Малюстени в южнй Молдавии, Румыния

Abstract: The paper comprises a revision and discussion of the systematic position of fossil turtles and tortoises from the classical „preglacial" locality at Mălușteni in southern Moldavia, obtained from or in the possession of the collection of the Geological Institute, University of Iași. Four discrete forms have been distinguished: a small land tortoise of the genus *Testudo* (sensu LOVERIDGE & WILLIAMS, 1957), two members of *Geoemyda* GRAY and one unidentified member of the *Chelydridae*. The name of one of the species discussed has been changed in accordance with the recommendations of the International Code of Zoological Nomenclature. The general part is concerned with a survey of the forms of the locality in question, its ecological and climatic conditions, as well as the stratigraphic significance of the Chelonian remains. The fauna is typical of the very border between the Pliocene and Pleistocene and resembles the corresponding faunas from a number of European localities of the same period,

INTRODUCTION

Măluşteni in southern Moldavia is one of the classical „preglacial" localities of Europe. SIMIONESCU (1930) was the first to publish a fairly detailed paper on the fossil vertebrate fauna from this locality and he touched on the occurrence

of numerous remains of turtles and tortoises representing the genera *Testudo*, *Clemmys*, and *Trionyx*.

MACAROVICI and VANCEA (1960) worked out the Chelonian fauna of this locality far more closely. They based themselves on materials collected by the previous investigator and their own materials, gathered later. They described three new species from Măluşteni and recorded the presence of two other — unidentified — forms.

KHOSATSKY and MŁYNARSKI (1966) have recently carried out a revision of the systematic position of one of the species described by MACAROVICI and VANCEA (op. cit.), having at their disposal some information received by letter and photographic materials by courtesy of Prof. N. MACAROVICI. Owing to that they managed to establish the lectotype.

At the time of my stay in Iaşi in November 1967 I was in a position to examine rich materials in the collection of the Geological Institute, Count Alexander Ion Cuza University. The results of the study are presented in this paper. It is related to a number of similar publications aimed at the revision of the systematic position of the European fossil turtles and tortoises.

I take occasion to express my deep gratitude to Prof. N. MACAROVICI, Director of the above-mentioned Institute, for rendering the collection accessible to me and permitting me to publish my finddings in this periodical and to Prof. T. JACZEWSKI, a member of the International Commission for Zoological Nomenclature, for explanations concerning some nomenclatural problems.

Family: *Testudinidae*

Testudo macarovicii n. sp.

1960. *Testudo praegraeca ibera* n. sp. MACAROVICI & VANCEA, pp. 377—380, Pl. I, figs. 1—11, Pl. II, figs. 1—6.
1964. *Testudo praegraeca ibera*, KUHN, p. 129.

Note: MACAROVICI and VANCEA (1960) described this species under the name of *Testudo praegraeca ibera*. From the viewpoint of order the use of this kind of specific names disagrees with the rules of the International Code of Zoological Nomenclature accepted by the Fifteenth International Congress of Zoology in London. Under Articles 52 and 57 of the Code the specific name montioned is the original homonym of the name *Testudo graeca ibera* PALLAS. Consequently, the name adopted by these authors should be, unedr Article 53, raplaced by another new specific name. Introducing a completely new name for this species, I base myself on the opinion of Prof. JACZEWSKI, Chairman of the Polish Section and a member of the International Commission of Zoological Nomenclature.

Holotype (= material): Geological Institute of the A. I. Cuza University in Iaşi, Romania.

Type locality and stratum: Măluşteni in southern Moldavia, Romania., Pliocene? („dépôts levantine“).

Name derivation: The new appellation is derived from the name of Prof. N. MACAROVICI.

Diagnosis: A small land tortoise having very convex carapace with its marginal edges even, not serrated. Precentral distinct, with straight sides converging frontwards, postcentral one and metaneural one. Pygals massive, strongly convex (see MACAROVICI & VANCEA, 1960, p. 379). Epiplastra broad, not narrowing anteriorly, pectorals narrow, evidently narrower than remaining plastral scutes. Anal notch distinct, triangular. Sculpture of scutes pronounced, coarse, and centrical. Probable shell length, about 20 mm.

Discussion. The shell remains of this species are fairly abundant in the material discussed. Besides them, there are, however, numerous shell fragments of the members of the genus *Geoemyda* (*Emydidae, Batagurinae*). Some of them, especially the pleurals and peripherals from the lateral portion of the carapace, are difficult to distinguish.

As has been noted by MACAROVICI and VANCEA (1960), this tortoise is very similar and stands close to the members of the modern eastern race of *Testudo gracea lbera* PALLAS. Undoubtedly, it, too, is a member of the „*antiqua-grecao*“ group (sensu SZALAI, 1934). And so, e. g., the presence of two metaneurals, which only exceptionally appear as a kind of morphological aberration in some species of the genus *Testudo* (sensu LOVERIDGE & WILLIAMS, 1957), has not been found here at all. The shape, size, proportions, and sculpture of the surface of plates are nearly the same as in both the nominative and the eastern race of the modern Grecian tortoise. It also resembles fossil *Testudo antiqua* BRONN (sensu SZALAI, 1934, 1935) to the same extent as they do. The bad fragmentary state of the material does not permit the reconstruction of the shell, and thus makes a close comparison impossible.

MACAROVICI and VANCEA (1960) compared this species with *Testudo bessarabica* RIABININ from the Upper Miocene and showed a number of essential differences between these forms. As I was in a position to compare the shell remains of the species under discussion with the very well preserved shell of T. *bessarabica* from Ciuburcu on the River Prut in Bessarabia, in the possession of the same collection, I can support their opinion thoroughly. *T. bessarabica* is a form standing close to but certainly distinct from *Testudo kalksburgensis* TOULA. Thus, it is near the group of small Tertiary testudinids of the genus *Geochelone* FITZINGER. However, the systematic position of the European species still needs a re-examination and thorough elaboration.

In the collection of the Geological Institute in Iaşi there are numerous shell fragments representing *T. macarovicii* and derived from several other Moldavian and Bessarabian localities approximate in age, e. g., Mizateşti, Plesea, and Berşti.

Family: *Emydidae*
Subfamily: *Batagurinae*

Geoemyda malustensis (MACAROVICI et VANCEA, 1960)

1960. *Clemmys malustensis* n. sp., MACAROVICI & VANCEA, p. 381, Pl. III, Figs. 3—24.
1962. *Clemmys malustensis*, MŁYNARSKI, p. 185.
1964. *Clemmys malustensis*, KUHN, p. 70.
1966. *Geoemyda malustensis*, KHOSATSKY & MŁYNARSKI, pp. 410—411, Pl. 33, Phots. 4—7.

Diagnosis: See KHOSATSKY & MŁYNARSKI (1966, p. 410).

Discussion: The material examined contains a large number of remains representing this species. A comparison of these remains confirmed our previous diagnosis but, at the same time, made it possible to find the presence of another similar though distinct form. A particular trait of the shell of this turtle is the radial sculpture of horny scutes, well seen on the surface of the carapace fragments, especially on the pleurals and proneurals (see MACAROVICI & Vancea, 1960, Pl. 3, Figs. 8, 9 and 11 and KHOSATSKY & MŁYNARSKI, 1966, Pl. 33, Phots. 4—6). The presence of pointed terminal xiphiplastral processes, which are bent downwards, is also evident (subgenus *Spinemys*). Simultaneously, a large number of fragments of rather uncharacteristic parts of a shell, with no distinct sculpture or mechanically polished by the action of water, may belong either to this species or to the subsequent one. It may well be, after all, that the pointed and so distinctive fragments of the xiphiplastra mentioned above belonged to a third form representing the genus *Sakya* BOGACHEV, 1960, close to *Sakya kovalevskii* ČKHIKVADZE, 1968 or *Geoemyda* (*Sakya*!) *riabinini* KHOSATSKY, 1946 (subfamily *Sakyinae*, see ČKHIKVADZE, 1968).

MACAROVICI and VANCEA (1960) write about the presence of *G. malustensis* in several other localities of Moldavia; in the material under study it can, however, be recognized for a certainty only in Mălușteni, although most of the remains obtained from the remaining localities also belong to some members of the genus *Geoemyda* (sensu KHOSATSKY & MŁYNARSKI, 1966)

Geoemyda cf. *mossoczyi* MŁYNARSKI, 1964

Synonymy and diagnosis: See KHOSATSKY and MŁYNARSKI (1966, pp. 407—408).

Discussion: The occurrence of this species or another very closely related form can be demonstrated on the basis of a large number of very characteristic shell fragments. This turtle was recorded, in addition to Mălușteni, from other „preglacial“ localities of Moldawia and Oltania. In the remains being discussed the presence of this form was found at Murgeni, Cancea, and Roșcani near Cururului as well as in the Pleșea region. In the case of all these fossils I managed to observe the following characters typical of the species in question: 1. the presence of a distinct neural keel ending in a tubercle on the pygal part

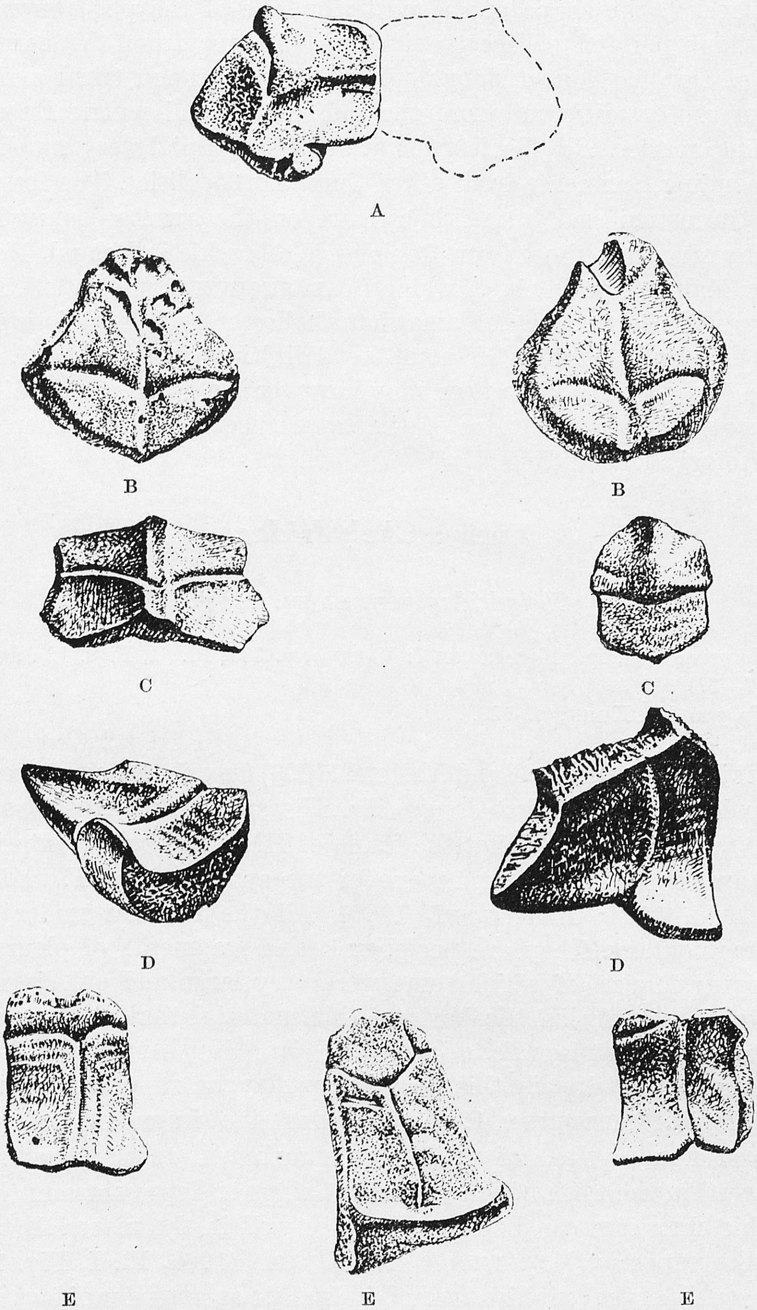


Fig. 1. *Geoemyda* cf. *mossoczyi* MŁYNARSKI. Natural size.

A. Interal surface of the left epiplastra. B. Two entoplastra characteristic of the genus *Geoemyda*. C. Neurals of *Geoemyda* cf. *mossoczyi* MŁYNARSKI, showing its clearly visible form of the distinct its medial keel, characteristic of this species. D. A peripheral from the very strongly serrated caudal margin of a carapace of *Geoemyda* cf. *mossoczyi* MŁYNARSKI in two different positions showing its arched shape. E. Peripherals of different specimens of *Geoemyda* cf. *mossoczyi* MŁYNARSKI. Their not very strong, characteristic sculpture is visible.

of the carpace, 2. the shape of the posterior lobe of the plastron with xiphiplastra without pointed endings, evidently different from the corresponding fragments of the plastron of *Sakya* sp., and 3. the concentrical and centrical sculpture of scutes, different from the radial or radial-centrical sculpture in the preceding species. All the fragments of this material very much resemble the corresponding fragments from other European localities. The fossil remains both from Mălușteni and from Irimești are on the average somewhat larger and more massive than those from Rębielice Królewskie in Poland, Hajnáčka in Slovakia or Kamenskoe in the Ukraine (Tarashchuk, 1965, p. 92). As a result the sculpture of scutes is here somewhat shallower and less distinct. This is the reason why these fragments cannot be definitively referred to *G. mossoczyi*. All these morphological differences may however, be equally well differencest, between two remote populations of the same species, living under somewhat different ecological conditions.

Family: *Chelydridae*

Chelydridae gen. et sp. indet.

1960. *Testudo grandis*, n. sp., Macarovici & Vancea, p. 381, Pl. I, Figs. 12a and b, Pl. II, Figs. 7—9.
1964. *Testudo grandis*, Kuhn, p. 120.

Discussion: Macarovici and Vancea (1960) described a new species of large tortoises under the name *Testudo grandis*. The authors referred also to Simionescu (1930), who supposed that the fauna of Mălușteni may comprise *T. syrmiensis* Koch, now thought to be one of the synonyms of *T. kalksburgensis* Toula (Szalai, 1934; Młynarski, 1966). All the remains under discussion are very fragmentary. They are peripherals and fragments of pleurals of specimens varying in size, of which some were very large and old. It may be ascertained quite reliably on the basis of this material that the remains by no means represent a tortoise (*Testudo* or *Geochelone*) but a member of the *Chelydridae*. Their membership in this very group may be supported by the following morphological characters: 1. the very massive fragments of peripherals have very pronouced signs of their loose attachment to the free ends of the ribs, preserved in the form of funnel-like openings or depressions in the internal surface. This character can be seen perfectly well in the material (type?) presented in the paper by Macarovici and Vancea (1966, Pl. I, Fig. 12b — defined erroneously as the „xiphisternum“, it consists as a matter of fact of peripherals VII and VIII of a large specimen). Such a loose type of attachment of the peripheral margin with the free ends of the ribs occurs only in the aquatic *Chelydridae* and marine *Cheloniidae*. The presence of these last, whose peripherals are besides narrover, is impossible in the material from Irimești. 2. The surface of the extant fragments exhibits a very distinct though delicate, vermicular sculpture, which is so characteristic of the *Chelydridae* and other primitive

turtles of the group *Chelydroidea.* 3. The width of the peripherals and their serration are similar to those in the fossil European and modern American members of the genus *Chelydra* GRAY.

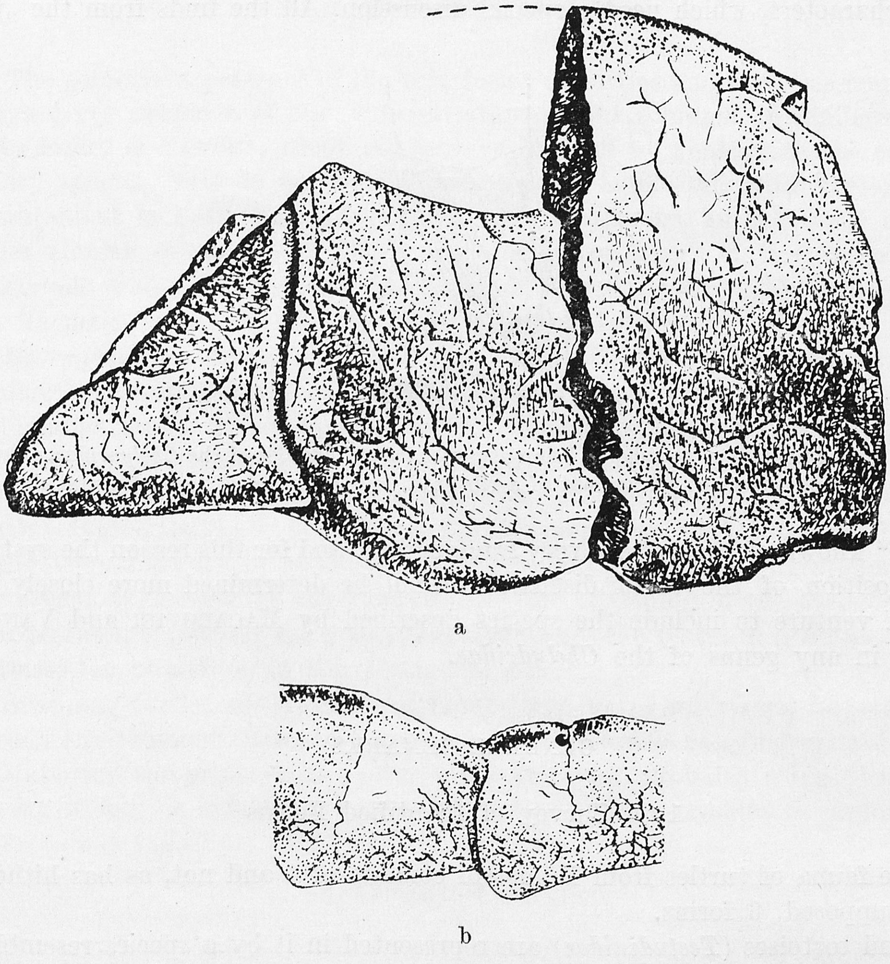


Fig. 2. A fragment of the peripherals of a large member of the *Chelydridae* (a) from Măluşteni and a corresponding fragment of the carapace margin of the modern species *Chelydra serpentina* (LINNAEUS) (b). Both specimens show their characteristic vermicular sculpture. Natural size.

Even at first sight the remains under study show a great resemblance to those of chelydrids from Hajnáčka in Slovakia (MŁYNARSKI, 1963), tentatively included in *Chelydra* cf. *dacheni* H. v. MEYER. There are similar peripherals derived from Brusturi in Transylvania (uppermost Pannonian) in the collection. of the Geological Institute in Budapest (MŁYNARSKI, 1966, pp. 224, 335, Pl 17, Phot. 1). The occurrence of members of this group of turtles towards the end of the Pliocene and at the beginning of the Pleistocene is discussed in a separate paper (MŁYNARSKI, 1968).

I wish to emphasize here once again that the systematic position of the European fossil chelydrids is not yet clear. They have characters of two modern genera *Chelydra* GRAY and *Macroclemys* GRAY, the characters of this first genus being far more pronounced. These forms also show peculiar craniological characters, which need a special discussion. All the finds from the „pre-

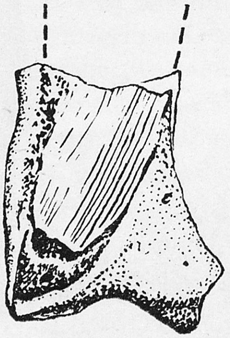


Fig. 3. A fragment of a peripheral belonging to a large member of the *Chelynridae*, showing the internal aspect of a fragment of a rib head, loosely attached to it. Natural size.

glacial" known at present are very fragmentary, and for this reason the systematic position of the turtle discussed cannot be determined more closely nor shall I venture to include the species described by MACAROVICI and VANCEA (1966) in any genus of the *Chelydridae*.

GENERAL REMARKS

1. A Survey of Identified Forms

The fauna of turtles from Mălușteni consists of 4 and not, as has hitherto been supposed, 6 forms.

Land tortoises (*Testudinidae*) are represented in it by a species resembling modern *Testudo graeca*. The remains described as *T. grandis* belonged to a large Snapping-turtle and those determined as *Testudo* sp. by MACAROVICI and VANCEA (1960) are for the most part fragments of *Geoemyda* cf. *mossoczyi* or juvenile *T. macarovicii*.

The so-called fresh-water turtles (*Emydidae*) are represented in the Mălușteni fauna by two species belonging to two distinct species of the genus *Geoemyda* of the subfamily *Batagurinae*. No members of the genus *Mauremys* (= *Clemmys*), mentioned by the previous authors, have been found at present. However, it seems strange that such a characteristic form of the „preglaçial" period as *Emys* cf. *orbicularis* (LINNAEUS) is wanting.

The presence of a large chelydrid has been detected in Mălușteni, but there are no remains at all of the members of the genus *Trionyx*, mentioned by SI-

MIONESCU (1930, Pl, V, Fig. 2). The remains discussed under this name are in fact fossils of large fishes of the group *Acipenseriformes* (dermal plates of large specimens with characteristic sculpture).

2. Ecological Conditions

The coincident presence of the four forms of turtles and tortoises mentioned above gives evidence of the differentiation of environment in Măluşteni (cf. MACAROVICI & VANCEA, 1960). As may be inferred by analogy to the contemporary species, *Testudo macarovicii* was a form associated with xerothermic, mountainous or hilly, but rather woodless environment. In Măluşteni it lived under similar conditions to those the modern members of the eastern race of *Testudo graeca* find in Dobruja (FUHN & VANCEA, 1961). Thus, this species has its pendant in the modern Romanian herpetofauna.

Geoemyda malustensis was probably associated with dry land environment. Similar forms from Bessarabia and Moldavia occur together with the typical steppe mammalian fauna. It is supposed that the pointed processes of the xiphiplastra were used by females of the genus *Sakya* (= subgenus *Spinemys*) to loosen the dry ground before laying eggs. *Geoemyda* cf. *mossoczyi*, too, is a form evidently adapted for life on land. These reptiles presumably inhabited brushwoods in the neighbourhood of water, but they certainly made long migrations across dry areas. At the end of the Pliocene and the beginning of the Pleistocene in Europe the members of the genus *Geoemyda* took the place, in a sense, of land tortoises, so numerous in the younger layers.

Snapping-turtles are dwellers of fairly large water reservoirs, because only in such environment these extremely predatory animals can find suitable food. In Măluşteni the presence of a large water reservoir, probably a big river overflowing widely, is evidenced by numerous finds of the remains of large fishes.

3. Climatic Conditions

Turtles and tortoises, as outstandingly thermophilous animals, have always been considered to be good climate indicators, but none the less the drawing of conclusions on the basis of their presence must be done very cautiously.

Testudo macarovicii is the most thermophilous of the forms that occur in the locality under study. Now the tortoises of this genus live in Europe only in the south, in areas having the Mediterranean climate. They tolerate drought and heat perfectly, but at the same time well endure severe winters, during which they hibernate. Specimens derived from laboratory breeding hibernated for several years at liberty in Poland and Germany.

Now the members of the genus *Geoemyda* live exclusively in areas of the tropical or subtropical climate. In spite of that their species, morphologically closely resembled by our fossil forms, live high in the mountains and tolerate

the cool and the fluctuations of temperature very well (KHOSATSKY & MŁYNARSKI, 1966; pp. 414—415).

The modern Snapping-turtles inhabiting America show various degrees of adaption. Inasmuch as *Macroclemys temminckii* (TROOST) is evidently thermophilous, which is indicated, above all, by its geographical distribution (see CARR, 1952 p. 52, map 1), *Chelydra serpentina* (LINNAEUS) is characterized by its uncommon stamina. The specimens living in Canada not only winter readily but were also observed to walk under the ice. In the literature on the rearing of animals there are records of specimens that having escaped from the breeding stations in Central Europe (Germany, Holland) lived at liberty for several years.

Summarizing, we connot state on the basis of turtles and tortoises that the climate of Măluşteni was particularly hot or downright „tropical''. Instead, it may be supposed that it was a climate of the Mediterranean type, perhaps somewhat more continental.

4. Stratigraphic Significance

Turtles and tortoises, being phylogenetically long-lived animals, are not a very good stratigraphic indicator. However, even here some regularities can be observed in their appearance and differences in the specific composition. I have recently drawn attention to the peculiar composition of the fauna of turtles from the border between the Pliocene and Pleistocene in Europe (MŁYNARSKI, 1968). In contradistinction to the younger periods, in which a great many land tortoises, including huge forms of the group *Geochelone*, occurred in all xerothermic land localities, the fauna of the period under discussion exhibits clear-cut differences. As I have already mentioned, the testudinids were here replaced by the members of the genus Geoemyda, which were in their full evolution. The European Pond Tortoise (*Emys* cf. *orbicularis*) appeared quite suddenly and big Snapping-turtles were present in sufficiently large water reservoirs. A similar faunal composition can be found in as many as about 20 European localities dated back to the Late Pliocene or Villafranchian. As regards the typical „preglacial'' fauna of turtles and tortoises from Măluşteni, I suppose that it, too, is a Pliocene-Pleistocene border fauna. It is probably more or less the same age as the fauna from Rębielice Królewskie (referred by KOWALSKI, 1960, to the Pliocene). This opinion would as a rule coincide with the supposition of MACAROVICI and VANCEA (1960), though it may well be that the locality represents a somewhat later period, namely, the Villafranchian, as suggested by SAMSON and RADULESCO (1965).

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STRESZCZENIE

Praca zawiera rewizję i dyskusję stanowiska systematycznego kopalnych żółwi ze znanego, „preglacjalnego" stanowiska w Mălușteni w południowej Mołdawii. W tym celu miałem możność przebadać materiały z wymienionego stanowiska, znajdujące się w Instytucie Geologicznym uniwersytetu Al. I. Cuza w Jassach. Stwierdzono w nich na pewno obecność czterech osobnych form: jednego niewielkiego żółwia lądowego z rodzaju *Testudo* (sensu LOVERIDGE i WILLILMS, 1957), dwóch przedstawicieli rodzaju *Geoemyda* i jednego bliżej nie dającego się oznaczyć reprezentanta rodziny *Chelydridae*. Ponadto możliwa jest też obecność przedstawiciela z rodzaju *Sakya*. Opierając się na przepisach Międzynarodowego Kodeksu Nomenklatury Zoologicznej opisano nowy gatunek *Testudo macarovicii* n. sp. Stwierdzono również, że szczątki zaliczone do

gatunku *Testudo grandis* MACAROVICI et VANCEA należały do dużych okazów *Chelydridae*. Nie potwierdzono obecności innych form podawanych dotychczas z omawianego stanowiska jak *Clemmys* i *Trionyx*.

Przegląd form z Mălușteni podano osobno w części ogólnej. Na ich podstawie możemy stwierdzić, że mamy do czynienia ze środowiskiem suchym, kserotermicznym oraz obszarami zaroślowymi nad brzegami większych zbiorników wodnych, prawdopodobnie rzeki. Na podstawie analizy wszystkich form żółwi można też stwierdzić, że klimat omawianego stanowiska nie był zbyt gorący, lądowy, podobny do klimatu współczesnej Dobrudży. Występowanie przedstawicieli *Geoemyda* i *Chelydridae* wskazuje na graniczny wiek między pliocenem a plejstocenem.

РЕЗЮМЕ

Работа является ревизией и дискуссией над систематическим положением ископаемых черепах, происходящих с известного „предледникового" места в Малюстени в южной Молдавии. С этой целью я имел возможность вновь исследовать материалы из упомянутой местности, находящиеся в Ясском Геологическом Институте им. Ал. И. Куза. В них несомненно установлено существование четырёх отдельных форм: одной небольшой сухопутной черепахи из рода *Testudo* (sensu LOVERIDGE и WILLIAMS, 1957), двух представителей рода *Geoemyda* и, не дающегося точно определить, представителя семейства *Chelydridae*. Кроме того здесь возможно присутствие представителя рода *Sakya*. Опираясь на положениях Международного Кодекса Зоологической Номенклатуры описано новый вид *Testudo macarovicii* n. sp. Установлено также, что останки, отнесенные к виду *Testudo grandis* MACAROVICI et VANCEA принадлежали к большим экземплярам *Chelydridae*. Не подтверждено присутствия других форм, описанных к настоящему времени из упомянутой местности как *Clemmys* и *Trionyx*.

Просмотр форм из Малюстени подан отдельно в общей части. На их основании можем утверждать, что имеем здесь дело с сухой, ксеротермической средой и заросшими пространствами над берегами больших водовместилищ, вероятно реки. На основании всех форм черепах также можно констатировать, что климат обсуждаемого места был не очень горячий, континентальный, похож на климат современной Добруджи. Присутствие представителей *Geoemyda* и *Chelydridae* указывает на возраст граничащий между плоиценовым и плейстоценовым периодами.

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